REMARKS

This communication is filed in reply to the Office Action mailed 8 December 2004.

Claims 2, 13, 56 and 63 have been cancelled, and new claims 64 - 73 have been added. Thus, claims 1, 3-12, 14-55, 57-62 and 64-73 are pending after this amendment. It is submitted that no new matter has been added by this amendment.

Several amendments have been made to the claims, as indicated in the listing of claims beginning on page 4 of this paper.

Claim 1 has been amended to claim that the aqueous acid solution in step (a) is an aqueous nitric acid solution, and to claim that the first heating stage in step (b) is carried out for at least 15 minutes at a temperature below 75 °C. There is support for the requested amendments in the application. The use of nitric acid is mentioned throughout the application. The at least 15 minutes time specification for the first heating stage in step (b) is supported, for example, at original page 3, lines 36-37. There is support for maintaining the temperature below 75 °C in the first heating stage of step (b), for example, at original page 3, lines 35-36.

Amendments to several of the dependent claims have been made as a result of the amendment to claim 1 to identify the acid as nitric acid.

New claims 64-66 claim different lengths of time that the lignocellulosic material in step (a) is contacted with the aqueous nitric acid solution (i.e. claim 64 claims more than 200 minutes, claim 65 claims at least 6 hours, and claim 66 claims at least 12 hours). The description makes clear that the lignocellulosic material may be contacted with the nitric acid in step (a) for as little as 30 minutes or less, and may extend for any length of time before degradation begins to occur. See, for example, page 14, lines 23-29. It is submitted that there is support for the subject-matter of claims 64-66.

New claims 67-68 claim different weight percentages of the nitric acid in the aqueous acid solution in step (a); in particular, claim 67 claims more than 22% by weight of nitric acid and claim 68 claims at least 24.15% by weight of nitric acid. There is support in the application for specifying the acid % to be more than 22%; see, for example, original page 3, lines 20-23, originally-filed claims 1 and 7-9, and Trials 2, 3, 4, 12 and 14 in Example 1. A nitric acid % of 24.15% is recited in Trials 2 and 12 of Example 1. It is submitted that there is support for the subject-matter of claims 67-68.

Claims 14 and 17 have been amended to recite only the lower end of the temperature range in view of the amendment to claim 1 to recite that the temperature during the first heating stage in step (b) is below 75 °C. Similarly, new claim 69 claims that the temperature during the first heating stage of step (b) is at least 60 °C. There is support for this amendment at, for example, original page 3, lines 35-36.

Dependent claim 18 has been amended to claim that the first heating stage of step (b) is carried out for more than 75 minutes. Some of the Trials in Example 1 show heating in the first heating stage for more than 75 minutes; see for example Trial 2.

New claims 70 and 71 claim time periods for carrying out the second heating stage in step (b); claim 70 claims that this is carried out for at least 11 minutes and claim 71 claims that this is carried out for about 11 to 59 minutes. Trial 17 in Example 1 provides support for the 11 minute limitation, and Trial 1 provides support for the 59 minute limitation.

Claim 40 has been amended to claim that the temperature range is from about 50 °C to below 75 °C.

New claim 72 claims that the aqueous nitric acid solution in step (a) is free of ammonium ions and aluminum, and new claim 73 claims that the aqueous nitric acid solution in step (a) consists only of nitric acid and water. There is support in the application for the subject-matter of these claims. For example, page 21, lines 34-36 explain the preparation of the nitric acid solution used in the Trials in Example 1 as being prepared with only 70% (w/w) nitric acid and distilled water.

Independent claim 54 has been amended in several respects. The starting moisture content of the lignocellulosic material has been added to the preamble of the claim. The amount of time that the lignocellulosic material is contacted with the aqueous nitric acid solution in step (a) has been claimed to be at least 12 hours. The aqueous nitric acid solution has been claimed to consist only of nitric acid and water and to comprise from about 24.15% to about 40% by weight of nitric acid. The first heating stage in step (b) is now claimed to be carried out for at least 15 minutes at a temperature below 75 °C.

Independent claim 55 has also been amended in several respects. This claim now claims that the lignocellulosic material is contacted with an aqueous nitric acid solution which is free of ammonium ions and aluminum and which comprises from about 10% to about 40% by weight of nitric acid. This claim has also been amended to claim that the lignocellulosic material is heated at a temperature up to about 75 °C for at least 15 minutes.

Independent claim 61 has been amended in several respects. The starting moisture content of the lignocellulosic material has been added to the preamble of the claim. The claim has been amended to claim that the aqueous acid solution in step (a) is an aqueous nitric acid solution being free of ammonium ions and aluminum and comprising from about 24.15% to about 40% by weight of the nitric acid. The claim has also been amended to claim that the first heating stage in step (b) is carried out for at least 15 minutes at a temperature below 75 °C, and that the second heating stage is carried out for about 11 to about 59 minutes. Step (c) has also been amended to recite a specific temperature at which the lignocellulosic material is contacted with the aqueous alkaline solution.

Amendments have been made to portions of the description on page 3 to provide increased conformity between the description and the claims.

In certain aspects, the Applicant's invention comprises a novel and inventive method for producing pulp and lignin from lignocellulosic material which involves a novel and inventive combination of steps wherein an aqueous nitric acid solution having a minimum weight percentage (about 10%) of nitric acid is contacted with lignocellulosic material to impregnate the material and then the impregnated material is heated, before alkaline digestion, under specific claimed time and temperature parameters. For example, claim 1

claims that the heating step takes place in two stages, the first of which is carried out below 75 °C for at least 15 minutes, the second of which being carried out above the boiling point of the nitric acid to distill off the nitric acid. The Applicant's claimed invention is a novel and inventive improvement over prior art processes, some of which have used solutions having very low acid concentrations, and some of which do not carry out heating of the impregnated material before alkaline digestion in order to depolymerize lignin. The Applicant's novel and inventive claimed combination of steps with acid concentration, time and temperature parameters allows high yield of pulp recovery while also allowing a high yield of lignin recovery, providing economic benefit because elements of the lignocellulosic material are being recovered rather than wasted.

Further novel and inventive aspects of the Applicant's invention include prolonged impregnation periods with the nitric acid solution prior to the heating and alkaline digestion steps. Further, the Applicant's invention also provides in certain aspects for recovery and recycling of the nitric acid after both the impregnation step and after the heating step. Further still, the Applicant's invention in certain aspects involves the impregnating nitric acid solution being free of ammonium ions and aluminum, or to consist only of nitric acid and water. Certain prior art processes have used nitric acid solutions, but have included ammonium ions or aluminum compounds. The Applicant's novel and inventive combination of steps with the temperature and time parameters, and the nitric acid concentration, do not require the use of such ammonium ions or aluminum to reach the results achieved. This results in a cost saving relative to certain prior art processes since these reactants are not employed, and is another example of how the Applicant's invention is patentably distinguishable from the prior art.

In the Office Action, the Examiner has objected to all of the claims under 35 U.S.C. 103(a) and has cited U.S. Patent Nos. 4,652,341 (the "'341 Patent"), 5,424,417 (the "'417 Patent") and 4,584,057 (the "'057 Patent"). The Examiner is respectfully requested to reconsider and withdraw these objections in view of the foregoing amendments and the following submissions.

The Examiner has cited the '341 Patent against all original claims in support of the 35 U.S.C. 103(a) objection, either alone (i.e. against claims 61-63) or in combination with the

other references (i.e. in combination with the '417 Patent against claims 54-60, and in combination with the '057 Patent against claims 1-53). As understood, the '341 Patent discloses a process of treating fibrous ligno-cellulose material which comprises contacting the ligno-cellulose material with a nitrate ion source to nitrate the ligneous component, and contacting the nitrated material with an alkaline extraction liquor to extract the nitrated ligneous component. The nitrating agent may include nitric acid.

The '341 Patent discloses the use of relatively low concentrations of the nitrate ion. At column 3, lines 31-35, the disclosure of the '341 Patent refers to a maximum weight percentage of about 9, but preferably not more than about 5.5. In contrast, each of the independent claims (1, 54, 55 and 61) in the present application requires a minimum of at least about 10% by weight of nitric acid. In particular, claims 1 and 55 each claim that the aqueous nitric acid solution comprises "from about 10% to about 40%" by weight of the nitric acid and claims 54 and 61 each claim that the solution comprises "from about 24.15% to about 40%" by weight of the nitric acid. It would not have been obvious to modify the method disclosed in the '341 Patent to increase the weight percentage of nitric acid since the '341 Patent expressly states that the weight percentage is to be a maximum of about 9 (see column 3, lines 33-34), and since the disclosure of the '341 Patent appears to specifically teach away from increased concentration levels for reasons of low usage, cost and elimination of a recovery system (see column 3, line 43 - column 4, line 2). See also column 6, lines 51 - 59 where the disclosure states that "...it is preferred to use as dilute a nitrating agent as possible with the limiting factors of time and pulp quality factors considered, say having a nitrating agent concentration ranging from 0.05 or 0.3 to about 7.0 to 7.5 weight percent, preferably less than about 4.5 or 5 weight percent." Similarly, see also column 9, lines 28 - 56, where the disclosure states that at approximately atmospheric pressure conditions, the HNO_3 liquor concentration may be up to about 5.5 weight percent, preferably up to about 5 weight percent, and when employing elevated pressures, the HNO_3 concentration may be no more than about 7 to 7.5 weight percent.

Also, independent claims 1, 54 and 61 in the present application claim heating the lignocellulosic material at a temperature below 75 °C for at least 15 minutes in a heating stage in step (b). While the '341 Patent discloses heating at or below 70 °C (see column 6, lines 63-68), this is part of the impregnation step which is carried out prior to the cooking

nitration step. Heating at a temperature below 75 °C for at least 15 minutes during the heating step as claimed in claims 1, 54 and 61 is not disclosed by the '341 Patent, and in fact, the '341 Patent appears to specifically teach away from heating below 75 °C during the nitrating cooking step because it would take "excessive reaction time": see column 7, line 56 - column 8, line 5.

Further, there is no motivation or suggestion to combine the teachings of the '341 Patent with those of either of the '417 Patent or '057 Patent to arrive at the Applicant's claimed nitric acid weight percentages or a heating stage being carried out at a temperature below 75 °C for at least 15 minutes. The '341 Patent appears to specifically teach away from both of these aspects of the Applicant's claimed invention.

Further, claims 55, 61 and 72 of the present application each claim that the aqueous nitric acid solution is free of ammonium ions and aluminum, and claims 54 and 73 each claim that the aqueous nitric acid solution consists only of nitric acid and water. In contrast, in the process disclosed in the '341 Patent where nitric acid is used as the nitrating agent it is augmented with an amount of an aluminum compound: see, for example, column 7, lines 8-10, column 4, lines 29-32 and column 2, lines 34-35. This is another example of how the Applicant's claimed invention is patentably distinguishable from the process disclosed in the '341 Patent, alone or in combination.

Accordingly, it is submitted that each of the independent claims 1, 54, 55 and 61 in this application define novel and inventive subject-matter and should be allowable. The Examiner is thus respectfully requested to withdraw the 35 U.S.C. 103(a) objections to these claims. It is also submitted that the remaining claims in the application should also be allowable, as they depend on claims which should be allowable.

In view of the amendments and submissions presented above, the Applicant submits that this application is in condition for allowance and respectfully requests reconsideration and allowance of this application.

Respectfully submitted,

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